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## Early evidence of Near Eastern viniculture

Neolithic jar from Khramis Didi-Gora, Georgia. Image courtesy of the Georgian National Museum.

As the climate in the mountainous Near East improved following the last Ice Age, Neolithic hunter-gatherers innovated viniculture of the Eurasian grapevine (*Vitis vinifera*). The earliest known chemical evidence for grape wine in the region dates to 5400–5000 BC in Hajji Firuz Tepe, an early Neolithic village in the Zagros Mountains of Iran. Focusing on two archaeological sites in Georgia in the South Caucasus, Patrick McGovern et al. (pp. E10309–E10318) performed a biomolecular archaeological investigation of newly excavated pottery jars of the early Neolithic period. The authors describe the jars' archaeological contexts and present positive chemical evidence of tartaric, malic, succinic, and citric acids, all of which are biomarkers of the Eurasian grape, as well as new radiocarbon age determinations in the range of 5800–6000 BC. The authors also present climatic and environmental reconstructions, including archaeobotanical evidence, of the abundance of grapes in the region during the early Neolithic. The authors note that jars similar to the newly recovered Neolithic vessels continue to be used to make wine in Georgia, illustrating that the culture of wine in the region has deep historical roots. The findings represent early evidence of viniculture, which subsequently spread worldwide and influenced human civilization, according to the authors. — T.J.

Brain reorganization and response to unseen stimuli in blind people

In a condition known as blindsight, damage to the primary visual cortex (V1) on one side of the brain impairs conscious perception of visual stimuli that appear on the opposite side of space, yet patients respond appropriately to unseen stimuli. Alessia Celeghin et al. (pp. E10475–E10483) combined behavioral and brain imaging techniques to examine how regions in the intact brain hemisphere might compensate for damage in the opposite hemisphere in a blindsight patient with left V1 damage. In a functional MRI experiment, the patient pressed a button to indicate the presence of a white square that appeared on either the right or left side of space in a
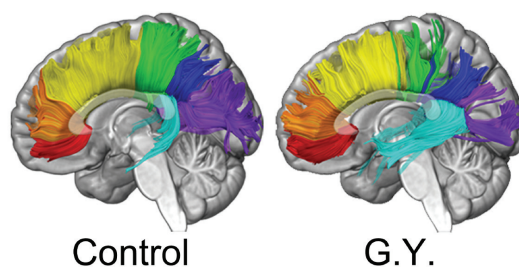
Patient G.Y. has unusually dense corpus callosum fiber tracts.

series of trials. Consciously perceived stimuli on the left side activated visually responsive brain regions confined to the right hemisphere. By contrast, unseen

stimuli on the right side activated regions involved in processing visual information and planning movements in both hemispheres, in addition to the corpus callosum—a bundle of nerve fibers connecting the two hemispheres. The findings suggest that behavioral responses of blindsight patients to unseen stimuli are mediated by enhanced activity in the intact hemisphere and increased communication between the hemispheres. According to the authors, the study illuminates the neural mechanisms that might enable nonconscious abilities and functional recovery after brain damage. — J.W.

Likelihood of Hurricane Harvey rainfalls in Texas

Hurricane Harvey produced rainfall averaging approximately 840 mm in the greater Houston metropolitan area. To assess the future likelihood of hurricane-induced rainfall of Harvey's magnitude, Kerry Emanuel (pp. 12681–12684) embedded a high-resolution, specialized computational hurricane model into coarse-resolution global climate analyses

Soldiers move through flooded Houston streets as floodwaters from Hurricane Harvey rise. Image courtesy of Zachary West (US Army).

and models. Based on three gridded climate analyses for 1981–2000, the author predicted that Houston would experience a rainfall in excess of 500 mm approximately once every 2,000 years; Texas was predicted to experience a rainfall of this magnitude

approximately once every 100 years. Six global climate models running representative concentration pathway 8.5, which is a business-as-usual greenhouse gas emissions scenario, predict that rainfalls greater than 500 mm could occur about once every 100 years by the end of the century in Houston and about once every 5.5 years by the end of the century in Texas. Assuming a linear increase in the frequency of hurricane rains, the models suggest that the current return rate for a rainfall in excess of 500 mm is approximately 325 years for Houston and approximately 16 years for Texas, according to the author. — L.C.

Role of gut microbiome in *Drosophila* reproductive isolation

Speciation experiments have shown that populations of the fruit fly *Drosophila* that are administered different diets can evolve assortative mating by diet. Recent research has suggested that diet-specific gut microbiomes may play a role in mediating fruit fly reproductive isolation according to host diet, but the findings remain inconclusive. Philip Leftwich et al. (pp. 12767–12772) used three test populations of *Drosophila melanogaster* to replicate previous experiments examining the effects of specific gut microbiomes on reproductive isolation. The authors found significant and replicable differences in the gut microbiomes of fly populations maintained on two different diets. The authors conducted mate choice trials after maintaining fruit flies on the two different diets for 5, 30, and 35 generations, and found no evidence of significant assortative mating by diet. When the authors manipulated *D. melanogaster* gut microbiome composition by eliminating the microbiome using an antibiotic and adding back *Lactobacillus plantarum* bacteria isolated from the fly guts, they found that fly matings were random in both cases. The results fail to support assortative mating by diet, and indicate that *D. melanogaster* mating preferences are not associated with differences in their diet or microbiome. The authors suggest that the fruit fly gut microbiome may not play a general role in driving the evolution of reproductive isolation. — S.R.

Livestock, food supply, and greenhouse gases

Reducing animal agriculture has been suggested to reduce greenhouse gas (GHG) emissions and increase food security. Robin White and Mary Beth Hall (pp. E10301–E10308) modeled the effects of removing farmed animals from the US agricultural system on the food supply and on GHG emissions. Elimination of animal agriculture removed all animal-derived foods from the diet. In the modeled scenarios, total food production by US agriculture without animals was 23% greater than with animals, primarily

due to increased availability of grains and legumes for food. In simulated diets for the US population based on actual foods available, relying solely on plant-derived foods that could be grown in the United States or are currently imported resulted in increased vitamin, mineral, and fatty acid deficiencies and increased excess of energy, compared with diets that included animal-derived foods. Agricultural GHG emissions from animal-free agriculture were 28% lower than from current US agriculture, but the reduction did not fully offset animal GHG contributions because of increased food crop production and the need to synthesize fertilizer to replace manure. The results suggest that removal of animals from US agriculture could result in unintended nutrient deficiencies and reduce GHG to a lesser extent than would be expected, according to the authors. — B.D.

Animal agriculture and GHG emissions. Image courtesy of the USDA/Bob Nichols.